REMARKS

The Examiner rejected Claims 1 and 5 under 35 U.S.C. 102(e) as being anticipated by Rothamel (US 6,639,206). Applicant traverses the rejection.

Claims 1 and 5 require an image of each reflective stripe to be formed on the photodetector with a magnification that depends on the radius of curvature of the circular cylindrical surface. The Examiner looks to Figures 1 and 6-7 of Rothamel, identifying surface 5 as the cylindrical surface recited in the claim and element 9 as the first track having reflective stripes 2 and non-reflective stripes 11. The Examiner maintains that an image of the reflective stripes is formed on the photodetector (element 3 in the figures) and that the image has a magnification that depends on the radius of curvature of the cylindrical surface. Applicant disagrees.

Applicant submits that the encoder taught by Rothamel fails to conform to two limitations of Claim 1 and Claim 5. First, no image of the stripes is formed, and second, the stripes are not part of the circular cylindrical surface of the drum. In the encoder of Rothamel, no image of the reflectors is formed on the photodetector, no less an image having a magnification that depends on the drum diameter. In each embodiment of the encoder of Rothamel, shown in the figures pointed to by the Examiner, the light source is focused to a point on the reflector surface. Rothamel makes this very clear in the accompanying text, in column 5 line 3 for Figure 1, and in column 5 line 61 for Figures 6 and 7. When the reflector is at the correct point in the rotation of the drum, the reflected light enters the photodetector. The image formed on the detector does not change in shape or size as a function of the curvature of the reflector. The curvature of the reflector merely determines the manner in which the image of the light source moves across the detector as a function of the rotation of the drum. The detector simply outputs a signal representative of the intensity of any reflected light reaching its surface (column 5 lines 7-10), which indicates whether a reflecting stripe having the appropriate orientation was or was not present at the focus of the emitted beam. In effect, the scheme taught in Rothamel allows for a better resolution than the prior art, since the signal is only received when both a place on the stripe is illuminated and the stripe is at the correct angular orientation.

In response to the Examiner's statement that the magnification inherently depends on the radius of curvature of whatever is being imaged, Applicant must point our that as no image of the reflective stripe is formed in the system taught by Rothamel, there is no relevant magnification to be considered. Furthermore, the Examiner's premise is clearly wrong. Consider a picture that is taken in a conventional camera of a scene that contains a convex mirror, the image is formed on a film plane in the camera, i.e., a detector. The mirror is imaged as part of the scene. The size of the mirror on the film plane depends only on the physical size of the mirror and is independent of the radius of curvature of the mirror. The scene pictured within the mirror in the final image will depend on the radius of curvature of the mirror, but the image of the mirror remains the same size.

The Examiner also points to Figure 1 as showing that the stripes are contoured to the shape of the drum. First, the level of detail that is available in Figure 1 is insufficient to determine if the stripes are flat surfaces as shown in Figure 4 or contoured to the surface of the drum as asserted by the Examiner. Second, all of the examples provided in the reference utilize a stripe pattern in which the surface of the stripes is not coincident with the surface of the drum. "It is well established that patent drawings do not define the precise proportions of the elements and may not be relied on to show particular sizes if the specification is completely silent on the issue" *Nystrom v. Trex Co.*, 71 USPQ2D 1241, 1250. Hence, Applicant submits that Claim 1 and the claims dependent therefrom are not anticipated by Rothamel.

The Examiner rejected Claim 2 under 35 U.S.C. 104(a) as being unpatentable over Rothamel in view of Chen (US 6,817,528). Applicant traverses the rejection.

The Examiner states that Rothamel teaches all of the limitations of Claim 2 except for disclosing that the light source emits a collimated beam of light. The Examiner looks to Chen to supply the missing teaching. The Examiner maintains that it would have been obvious to one skilled in the art to provide the the encoder in Rothamel collimated lenses to collimate light rays for each light source for the purpose of maintaining alignment of the active lighting area with the area of the photodetector during drum rotation. Applicant disagrees.

First, as noted above with respect to Claim 1, Rothamel does not teach that a

magnified image of the stripes is formed and that the stripes are part of the circular cylindrical surface of the drum. Chen does not supply the missing teachings. Second, Rothamel specifically teaches that the light source generates a focused beam of light such that the light emitter in the light source is focused to a spot on the surface of the reflectors. The scheme taught in Rothamel (column 5 line 3 and line 61) depends on focusing the light on the reflectors. Hence, replacing the focused light source with a collimated light source would lead to an encoder that did not function in the manner intended by Rothamel.

In addition, the Examiner suggests that the motivation to apply the teachings of Chen to the scheme taught by Rothamel would be "maintaining alignment of active lighting area with the area of the photodetector during drum rotation". Applicant must respectfully point out that replacing a focused beam with a collimated one would actually render the scheme taught by Rothamel less tolerant to angular misalignment than before, making the match between the lighting area and the photo detector less certain. Accordingly, there is no reasonable expectation of success in making the combination suggested by the Examiner. Hence, Applicant submits that Claim 2 is not obvious in view of the cited prior art.

The Examiner rejected Claims 3 and 4 under 35 U.S.C. 103(a) as being unpatentable over Rothamel in view of Suganuma (US 6,448,996). Applicant traverses the rejection.

The Examiner states that Rothamel teaches all of the limitations of Claims 3 and 4 except for disclosing that the drum rotates about said axis when a shaft is rotated and said shaft is coincident with said axis. The Examiner looks to Suganuma for the missing teachings. As noted above with respect to Claim 1, Applicant submits that Rothamel fails to teach that a magnified image of the stripes is formed and that the stripes are part of the circular cylindrical surface of the drum. Suganuma does not supply the missing teaching. Claims 3 and 4 depend on Claim 1. Hence, Applicant submits that Claims 3 and 4 are not obvious in view of Rothamel and Suganuma.

Although the Summary sheet of the office action dated 10/10/2006 showed Claim 6 as having been rejected, the Examiner did not provide detailed grounds for rejection in the pages that followed. Applicant presumes that the Examiner intended to maintain

the rejection of Claim 6 under 35 U.S.C. 103(a) as being unpatentable over Rothamel, as detailed in prior office actions, and will respond accordingly. Applicant traverses the rejection.

Claim 6 depends from Claim 1 and further requires that the first track lies between the circular cylindrical surface of the drum and the axis of the drum. That is, the track is on the inside surface of a hollow drum. The Examiner admits that Rothamel does not provide the additional teaching but maintains that it would be obvious to make the change since it would lead to a more compact design.

First, as noted above with respect to Claim 1, Applicant submits that Rothamel does not teach that that a magnified image of the stripes is formed and that the stripes are part of the circular cylindrical surface of the drum. The Examiner does not suggest a motivation for modifying the teachings of Rothamel to satisfy this limitation. Second, the Examiner states that providing an arrangement where the components operate from within the drum would allow the device to be manufactured at a smaller size. Applicant disagrees. Applicant points out that moving the source/detector package to the inside of the drum presupposes that the drum is, or can readily be made to be hollow, with the cavity accessible from one end, and still function properly. The Examiner has not pointed to any teaching in Rothamel suggesting that this presupposition is valid. Applicant also submits that even in cases where it is possible to do so, moving the source/detector package to the inside of the drum would involve creating a structure to maintain the position of the package independently of the rotational motion of the drum around it. Such a structure would not necessarily lead to an overall device size any smaller than the one taught by Rothamel. Hence, Applicant submits that Claim 6 is not obvious in view of Rothamel.

The Examiner rejected Claim 7 under 35 U.S.C. 103(a) as being unpatentable over Rothamel in view of Karim-Panahi (US 5,438,882). Applicant traverses the rejection.

The Examiner states that Rothamel teaches all of the limitations of Claim 7 except for disclosing a second track comprising alternating reflective and non-reflective stripes arranged on said circular cylindrical surface, a second light source for illuminating stripes at an oblique

angle relative to said normal; and a second photodetector positioned to receive reflected light from reflectors which form images of the light source on the photodetector during rotation of the drum relative to said second photodetector. The Examiner looks to Karim-Panahi for the missing teachings.

First, as noted above, Rothamel fails to teach that a magnified image of the stripes is formed, and that the stripes are part of the circular cylindrical surface of the drum. This limitation is recited in Claim 1 from which Claim 7 depends. Karim-Panahi does not provide the missing limitation.

Second, the Examiner maintains that it would have been obvious to one skilled in the art to provide in Rothamel a second track of alternating reflective and non-reflective stripes, a second light source and a second photodetector, as taught by Karim-Panahi, for the purpose of collecting more data on the periodic motion of the rotating member. Applicant disagrees. Karim-Panahi teaches using a second track and a processing system for the purpose of detecting phase shifts between the two tracks to detect distortion of the shaft about which the tracks rotate. The purpose of the apparatus taught by Rothamel is to provide information on angular position in a plane normal to the axis of a rotating shaft, not information on distortion of a rotating shaft. The addition of a second track as taught in Karim-Panahi is of no use in the apparatus of Rothamel since it cannot provide additional angular position information absent some additional teachings, which the Examiner has failed to identify. Accordingly, Applicant submits that Claim 7 is not obvious in view of the cited references.

Claim 7 has been amended as shown above to rectify a typographical error.

The Examiner rejected Claim 8 under 35 U.S.C. 103(a) as being unpatentable over Rothamel in view of Karim-Panahi and Cohen (US 4,124,839). Applicant traverses the rejection.

Regarding Claim 8, the Examiner stated that the combination of Rothamel and Karim-Panahi discloses the claimed invention as stated above except for the limitation that the drum comprises two tracks where the widths of the stripes of the first track are different from the widths of the stripes of the second track. The Examiner looks to Cohen (Figure 4) for the

missing teachings. The Examiner maintains that it would have been obvious to one skilled in the art to modify the combination of Rothamel and Karim-Panahi in view of Cohen for the purpose of providing additional encoding data to the system (col. 9, lines 23-27).

First, Applicant repeats the arguments made above with respect to the missing teachings in the combination of Rothamel and Karim-Panahi with respect to Claim 1 from which Claim 8 also depends. Cohen does not provide the missing teachings.

Second, Applicant maintains that the use of reflective stripes of different widths, as taught by Cohen, would offer no benefit in the device taught by Karim-Panahi. Applicant points out, as noted above with respect to Claim 7, that the purpose of the device taught by Karim-Panahi is to detect axial distortion along a rotating shaft.. Karim-Panahi teaches the use of two axially separated tracks of reflectors to generate two different trains of pulses whose relative phase shift is indicative of shaft distortion. Applicant submits that no additional information of any value to the measurement of distortion would be gained if the two separated tracks of reflectors were to have stripes of different widths.

Third, Applicant submits that the use of tracks having different track widths in the device of Karim-Panahi would actually degrade device performance. The device taught in Karim-Panahi measures the phase difference between the two tracks with stripes that are spaced evenly around the track at some notch mark spacing. Each track generates a periodic signal having a frequency that is many times that of the rotational motion of the shaft thereby allowing phase shifts that occur in a time that is much less than the period of rotation of the shaft to be detected. The device taught in Karim-Panahi detects shifts in the phase shift between two cycles of the higher frequency. The Examiner argues that one could use two tracks such as those shown in Cohen in the apparatus of Karim-Panahi and still measure a phase shift resulting from a distortion of the shaft. The Examiner suggests that the signal resulting from any pattern of stripes disposed on a track can be compared to the signal resulting from a different pattern disposed on the second track and a phase shift between the two signals determined. The Examiner does not point to any teaching in the art that supports this contention that two tracks having periodic stripes of different widths can be compared with the required accuracy. Basically, the Examiner argues that each of the differently structured tracks generates a signal of the same frequency, namely, the signal generated by

one rotation of the shaft. Applicant must respectfully point out that for a series of N stripes disposed on the track, the frequency of rotation of the shaft is a factor of N smaller than the frequency of the pattern generated by the series of stripes. In the scheme proposed by the Examiner, the detection of phase shift would be correspondingly limited, with a resolution degradation of that same factor of N. Applicant fails to see how this degradation of the measurement that is the objective of the scheme taught by Karim-Panahi could be considered to be a motivation to make the change suggested by the Examiner.

Accordingly, Applicant submits that the Examiner has not made a *primia facia* case for obviousness with respect to Claim 8.

I hereby certify that this paper is being sent by FAX to 571-273-8300.

Respectfully Submitted,

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